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THE TEST RESULTS OF SOLAR COLLECTORS WITH TEXTILE ABSORBERS OF TUBULAR TYPE.

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Increasing the use of solar energy in the autonomous heating systems involves the development of efficient and low-cost collectors with absorbing panels (absorbers) of non-metallic, including textile materials (industrial fabrics and polymer compositions of tissue). For the preferred type of the panels of the flow sleeve fabric of polyester filaments, which are characterized by equality rupture strength and elongation in warp and weft have high strength and stability of form and dimensions, may operate under pressure at temperatures up to 170 ° C.

The **purpose of research** - testing the collector with a tubular absorber in laboratory and field conditions, and the determination of its thermal characteristics.

Materials and methods of research. For the distribution of the coolant channels tubular absorbers have two hydraulic manifold of polypropylene pipes with a diameter 42h50 mm and a length of 600 mm, in which the pitch of 30 mm were welded fittings smaller diameter. They are using a heat-shrinkable polymeric sleeve textile tubes were fixed; surface fittings annular grooves were filled at the time of installation of sealant. Dimensions absorbers - 580h1380 mm, their area of 0.8 m2, the specific weight of 2.8 kg / m2, a private capacity 9.6 liters; they had 18 channels for coolant flow.

After crimping with water under a pressure of 2.5 bar during the day absorber was painted black acrylic enamel and mounted in a rigid housing of the solar collector (its size 620h1420h75 mm) on the bottom and side surfaces of which was laid a layer of thermal insulation (foamed polypropylene of thickness 10 mm) . On top of the housing has a transparent cover - polycarbonate sheet of 4 mm thickness. Its effective thermal conductivity at room temperature, defined on the device LKT-1, was 0.066 W / mK. The transmission spectrum of the polycarbonate in the ultraviolet and visible regions was investigated using spectrophotometer SPECORD M-40. Polycarbonate is opaque to radiation at wavelengths λ <380 nm, and thus protects the polyes-

ter textile panel from damaging hard ultraviolet. In the visible transmittance it is 81,5-82%.

Rejection of traditional solar energy materials (metal and glass) will significantly reduce the specific gravity of the collector (it is 6.4 kg / m2) and to increase its impact resistance while maintaining high thermal performance, which was confirmed by laboratory data (in the simulator of solar energy) and field tests.

These tests were conducted using the universal method of quasi-stationary thermal-hydraulic test a closed-loop circulation of the coolant. The stand was mounted on a movable platform; placed on it at the same time 2 collectors, each of which can independently be connected to the circulation circuit via three-way valve. The automated system of recording and processing of experimental data, connected to a personal computer, allow at specified intervals to record and archive the results of measurements of temperature, flow rate of the water and the intensities of the radiant flux. On the stand determined by the instantaneous collector efficiency.

The results of research. Regression equations were derived for the instantaneous collector efficiency with tubular textile absorbers.

For collectors with tubular absorbers were held and independent measurements of coefficients of heat loss using the method of the regular cooling mode. They were carried out during the cooling reservoir with fluid circulation is disabled; experiments a fixed temperature of water in the panels at different times.

The textile sleeves absorbers has been experimentally established effect of the intensification of the heat transfer fluid when washing the surface of the fabric. The average coefficient of convective heat transfer in polyester sleeve with latex coating was determined indirectly using a modified method of Wilson. When the laminar flow of water values of 2.1 - 2.3 times higher than the corresponding values for smooth pipes. This is due to the discrete roughness textile heat transfer surface, manifesting itself in two ways. On one side surface of the fabric becomes more developed in comparison with the smooth wall (the effect of the fins), and on the other - for each element of the protrusion may cause vortices breaking laminar boundary layer structure.

Along with the experiments, we identified a number of characteristics of tubular textile absorbers methods of mathematical modeling. Thus, for example, were calculated distribution of liquid flow in the channels and additional radiation absorber flows through reradiation substrate channel walls.

It is clear that the unevenness of coolant flow inevitably leads to thermal absorber, and the latter, in turn, causes a decrease in the efficiency of the collector.

The design of the absorber is tubular, that at relatively low angles of incidence of sunlight radiating part flow through the gaps between the tubes reaches the substrate, covering the bottom of the manifold housing. In turn, this substrate will emit energy at the absorber. Due to this phenomenon additional heat flow depends on a step in the absorber pipes and the angle of incidence. The methods of geometrical optics were calculated for the re-emission of two types of substrates - absolutely black emitter in accordance with the law of Lambert and the reflecting mirror. Optimal step textile tubular channels in the absorber was found to be (2 ... 2,5) .R, where R - radius of channel m.

Conclusions

Studied thermal performance of solar collectors with textile tubular absorbers in laboratory and field conditions. For them, the above values are determined optical efficiency and loss factor. Experimentally established effect of the intensification of the heat transfer fluid when washing the inner surface of the textile in the channel.

Model calculations, will optimize the channel steps in tube absorbers and circuit coolant feed them. Calculation of technical and economic performance data collectors showed that they pay for themselves in two seasons of operation.